Commission Briefing Paper 6B-01

Observations on Scenario 1: Maximum Operations

Prepared by: Section 1909 Commission Staff
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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU.

Section 1909 requires the final report of the Commission to include an assessment of future needs over 15-, 30-, and 50-year time horizons. A number of alternative scenarios are being developed that make different assumptions about future transportation system emphasis. This paper describes selected observations pertaining to Scenario 1, the "Maximum Operations" scenario.

Background

Scenario 1 was created as a result of direction by the Commissioners to make a distinction between the Base Case (where the speed with which operations strategies are being applied is in line with current, albeit gradual, trends) and a vision of a transportation world where the most aggressive feasible applications of operations strategies are being applied. The purpose of the Maximum Operations Scenario is to isolate the effect that such a level of operations strategies would have on overall surface transportation system performance. While this scenario is ultimately envisioned to cover highways, transit, freight rail, and waterways, the results available at this time pertain to highways only.

This scenario also contains a safety component, identifying the potential impacts of devoting alternative levels of funding into the aggressive enforcement of safety laws and regulations. Since the safety analyses were conducted independently of the remainder of this scenario, these findings are discussed separately in another paper (6B-06), reflecting the fact that the alternative safety approaches associated with the 5 scenarios could readily be interchanged with each other in different scenarios.

The table below identifies operations strategies that are reflected in the base case and Scenario 1. These are not an exhaustive list of all possible operations strategies; instead they represent a set of strategies for which performance impacts can be quantified to some extent using currently available data and models. Other strategies could be adopted in combination with the strategies shown to produce larger impacts on operational performance. As noted in the table, one major category of operations strategies, road weather management, is not reflected in the quantitative impacts identified under this scenario due to data and modeling limitations. This scenario reflects only existing technologies; the potential impacts of new technologies are reserved for scenario 5.

Highway Operations Strategies Included in the Base Case and Scenario 1			
		Base Case, Existing Trends	**Scenario 1, Aggressive**
Freeway Management			
	Ramp Meter Level (Centrally Controlled)	Deployed on selected highly congested routes	Deployed on a wider range of moderately congested routes
	Electronic Roadway Monitoring	Added on selected freeways	Deployed on all freeways
	Variable Message Signs	Deployed on selected highly congested routes	Deployed on a wider range of moderately congested routes
	Traveler Information	Assumes deployment of 511 Traveler Information Systems	Assumes 511 and Private ISPs
	Variable Speed Limits	None	Deployed on a wide range of moderately congested routes
	Integrated Corridor Management	None	Deployed on a wide range of moderately congested routes
Incident management			
	Detection Algorithm / Free Cell	Deployed on selected highly congested routes in large cities	Deployed everywhere
	Closed Circuit TV Cameras	Deployed on selected highly congested routes in large cities	Deployed in conjunction with incident detection
	On-Call Service Patrols; TMC integration/coordination	Deployed on selected highly congested routes in large cities	Deployed in conjunction with incident detection
Road Weather Management (snow/ice/fog)		Not deployed	Not deployed
Transportation Management Center (TMC)			
	Deployment	Deployed in selected large urban areas	Deployed in wider range of urban areas
	Software Effectiveness	Upgrade software for existing TMCs	Upgrade software for new TMCs 10 years after construction

When interpreting the results of this scenario, it is important to note the considerable impact that the continuation of existing deployment trends within the base case could be expected to have on highway operational performance. While barriers to the deployment of operations strategies have been slowing their current rate of implementation, sustaining the current rate of deployment over 50 years would result in a system in which these strategies have been fully adopted in the most critical areas. Moreover, whereas the base case assumes the most congested routes are targeted, scenario 1 augments the base case by targeting less congested routes that will have lower initial payoffs than would congested facilities (at least until congestion builds). The benefits of aggressive deployment are thus more likely to be observed in intermediate time periods as strategies are still being adopted, rather than at the end of the analysis period.

Findings and Observations - 2020

The analysis indicates that at current sustainable funding levels, the widespread adoption of operations strategies would result in some reduction in average delay on urban principal arterials in 2020 (from 6.9 to 6.7 hours per 1000 VMT) relative to the base case (note, however, in either case average delay would be higher than in 2005). This relative improvement in operational performance would be achieved despite a reduction of approximately 1,700 in the number of new lane miles added over the 15-year period.

The “medium funding level” (defined as the minimum amount required to at least maintain major performance indicators at 2005 levels over a 30-year period) is not significantly different between the base case and scenario 1 for the 2005 to 2020 period, suggesting that the primary benefit of accelerating the rate of operations deployments comes is the reduction of approximately 2,600 in the number of new lanes miles added over the 15-year period.

The “high funding level” (an amount sufficient to support all cost-beneficial investments) is slightly lower under scenario 1 than the base case, but generates slightly better performance in terms of average delay relative to the base case (note that in either case average delay would be lower than in 2005). The total number of lane miles added would be reduced by approximately 2,600 over the 15-year period.

Findings and Observations - 2035

The analysis indicates that at current sustainable funding levels, the widespread adoption of operations strategies would result in some reduction in average delay relative to the base case (note however, in either case average delay would be higher than in 2005). However, under scenario 1 a similar level of traffic volume could be accommodated with approximately 2,100 fewer lane miles than in the base case.

By definition, the medium funding level results in a similar level of performance in terms of average delay on urban principal arterials and the percentage of VMT on roads with acceptable ride quality. However, this level of performance was achieved at a slightly lower cost than the base case. The number of new lane miles added over the 30-year period would be reduced by approximately 6000 under this scenario.

The level of cost-beneficial investments under Scenario 1 would be a little higher than under the base case; this higher funding level would achieve slightly greater reductions in average delay relative to 2005. The average vehicle would save an hour per year in terms of reduced delay.

The number of new lane miles added would be reduced by approximately 1,400 over the 30-year period; in many cases, it will still be cost beneficial to add more lane miles whether or not operations strategies are implemented, but the effectiveness of those highway expansions will be greater if implemented in conjunction with the deployment of operations strategies.

Findings and Observations - 2055

By 2055, the analysis indicates that at current sustainable funding levels, the results of the base case and Scenario 1 would be very similar, suggesting the rate of deployment under existing trends would have finished catching up to the more aggressive deployment patterns assumed in the scenario. However, under scenario 1 a similar level of traffic volume could be accommodated with approximately 4,200 fewer lane miles than in the base case.

Similarly, the base case and Scenario 1 are largely identical in terms of their medium funding level, and their performance in terms of average delay on urban principal arterials and the percentage of VMT on roads with acceptable ride quality. Note that in both cases average delay is significantly higher than in 2005, as the cumulative impacts of population and travel growth over 50 years make it increasingly difficult to identify locations in which a sufficient number of lane miles could be added in a cost-effective manner to handle the increased demand. (This is particularly a problem in the largest urbanized areas).

The level of cost-beneficial investments under Scenario 1 would be remain a little higher than under the base case; this higher funding level would achieve slightly greater reductions in average delay relative to 2005. The average vehicle would save an hour per year in terms of reduced delay. The number of new lane miles added would actually be slightly higher under Scenario 1 relative to the base case, as the application of operations strategies in conjunction with capacity expansion would increase the effectiveness of widening projects, making them more likely to be cost-beneficial.

General Observations

While the level of performance in Scenario 1 generally meets or exceeds that of the base case, the differences are not as profound as one might expect. Part of this is due to the fact that a significant amount of operations technology has already been deployed under the base case, often to the highest payoff locations, and that the continuation of existing trends would gradually result in significantly expanded coverage of such technologies over time. Thus, Scenario 1 does not represent that significant a departure from what might be otherwise be expected to occur.

Digging more deeply into the analysis results into additional performance indicators not included in the summary tables reveals that Scenario 1 is significantly more effective in reducing certain types of delay on certain portions of the system than the base case. In 2035, incident delay on urban interstates in small urbanized areas would be reduced by 42 percent. This is consistent with the aggressive deployment strategy assumed in Scenario 1 that would extend operations strategies to a broader range of locations than might be covered in the base case.

As noted above, the operations strategies considered as part of this scenario are not an exhaustive list of all possible approaches, but instead consist of those that are most readily quantified. It is likely that the potential benefits of operations strategies are higher than can be directly computed.